

Republic Day

Wednesday 26th January 2022

Dear Colleagues, friends, ladies and gentlemen

I welcome you all on the occasion of 73rd Republic day. I extend warmest greetings from the pristine settings around us which not only make us feel proud but also symbolise our journey towards a self-reliant India.

On this day, seventy-two years ago, we declared our nation a Sovereign Democratic Republic State and bestowed upon us a constitution which enshrines justice, liberty, equality and fraternity. These values have unified our nation while we take pride in its diversity.

The philosophy treasured in our constitution has contributed to the development of our centre as well. Our organisation took birth in 1954 to harness the power of atom for wellbeing of our young nation. The journey till date has been tough but satisfying. Our mandate remains broad based with emphasis on basic and applied research, technological development and deployment of core and spinoff nuclear technologies for the benefit of society.

It is about right time that we reflect upon the success and milestones achieved in year gone by. I shall be listing some of these on this august occasion.

The nuclear fuel cycle related activities at this Centre, namely fuel fabrication, reactor operations, fuel recycling and waste management, are the foundational activities of BARC and I shall begin with a brief report on these activities

1. Research reactor Dhruva continued to operate with a high level of safety and availability. The overall availability factor for the year 2021 was 71%.

- During the year, around 500 samples were irradiated for radioisotope production in tray rods and pneumatic carrier facility.
2. Apsara-U reactor achieved operation at its rated power of 2 MW on 8th October 2021. The reactor operated with an availability factor of 90% during the year 2021. Total 44 isotope cans were delivered after irradiation.
 3. Critical Facility for Advanced Heavy Water Reactor (AHWR) was operated on 72 occasions. 25 nuclear detectors were tested and 98 samples were activated.
 4. Regular production of Fast Breeder Test Reactor (FBTR) fuel and Dhruva Fuel continued as per present capacity of production line. Required FBTR Fuel sub-assemblies were supplied to IGCAR, Kalpakkam to raise the power to maximum design level of 40 MWth.
 5. Fuel Fabrication Plant at Tarapur continued to perform well, meeting the production targets.
 6. Post Irradiation Examination and Non-Destructive Examination were carried out for primary recirculation pipeline weld joint of TAPS-1 BWR.
 7. A new facility named Special Plate Facility (SPF) has been completed to meet regular target requirements for fission moly programme.
 8. The Reprocessing Plant at Kalpakkam KARP II continued its excellent performance and achieved record production in 2021.
 9. Operation of the Waste Management Plants of NRB at Tarapur and Kalpakkam, Plutonium Plant, Metallurgical Waste Processing Facility, Waste Immobilisation Plant and Waste Management Facilities such as Effluent Treatment Plant and Decontamination Centre continued for intended purpose at capacity level.
 10. The Joule heated Ceramic Melter at Waste Immobilization Plant at Kalpakkam entered its fifth year of continuous hot operation.

11. A new version of axial creep measurement system for PHWRs has been designed, developed and successfully tested at site. The system is compatible with latest technology and is ready for deployment in plants.
12. An artificial intelligence based Online Event Identification System (OLEIS) Software Tool for 220MWe PHWR KGS 1&2 has been developed under BARC-NPCIL collaboration. The software tool has been integrated with Kaiga 220MWe PHWR simulator at NPCIL with satisfactory performance.

Several technology initiatives and projects have achieved important milestones or reached completion. Some of these activities are as follows

13. Full scale demonstration of a gantry-type cargo scanner has been done at BARC, Trombay. This scanner moves over a container trailer within a radiation shielded area to produce an X-ray image of the object. The performance of core technology was on par with the similar kind of commercial products available in the international market.
14. 10MeV RF LINAC technology was transferred to two entrepreneurs for food irradiation applications. Indigenous Electron beam welding/melting machine technology was transferred as import substitute.
15. A novel colorimetric method for ascertaining the potability of water was developed to identify arsenic contamination free water sources and for assessing the efficacy of arsenic remediation technology.
16. Technology has been developed and demonstrated for purification of oil contaminated water using micro-bubbles of ozone. The treated water is suitable for irrigation purpose.
17. The first indigenous and cost effective Certified Reference Material (CRM) of dolomite (BARC B1101) was prepared jointly by BARC and AMD using

starting material sourced from Tumallapalle. It was released by Chairman, AEC.

18. BARC's indigenously developed Alkaline Water Electrolyzer technology for Hydrogen production was transferred to HPCL and BPCL. These PSUs will collaborate with BARC for scaling up the technology under incubation programme.
19. Ultrasonic Testing (UT) based online Interface tracking system for liquid-liquid solvent extraction process has been deployed at BARC.
20. Installation and Commissioning of Terrestrial Trunk Radio network (TETRA) for transfer of background radiation data inside BARC campus for real time monitoring at ICCM has been completed.
21. Computer Division has augmented the BARC Cloud Computing Service 'Megh' with a new system called 'Megh-3' having 1800 computing cores and 27 Terabytes of memory. With this addition, the total number of computing cores of BARC's Cloud Computing systems now stand at 3680.
22. A Quick Scan Whole Body Monitor has been indigenously developed and the technology was transferred to meet the requirements for quick & efficient monitoring of radiation workers by DAE facilities, Defense and NDRF for internal contamination.
23. An integrated process comprising hydro and pyro-metallurgical unit operations has been developed and demonstrated successfully for the recovery of >99% pure cobalt and nickel metal powders from alloy steel scrap. Technical know-how has been transferred to Heavy Water Board for setting up a plant for large scale processing of the scrap.
24. Solvent extraction process flowsheet has been developed for the production of high purity terbium oxide (>99%) from heavy rare earth concentrate

produced by IREL. Technical information has been shared with IREL for commercial production at its plant.

25. A compact permanent magnet based Thermal Ionization Mass Spectrometer for precise isotope ratio measurement of Lithium isotopes was developed and deployed at BARC.
26. Low Level Hydrogen Detection System for detecting hydrogen content in Liquid Sodium coolant of Fast Breeder Reactor was developed and 12 of these were commissioned at BHAVINI, Kalpakkam.
27. Indigenous Passive Catalytic Recombiner Device (PCRD) for management of hydrogen under accident conditions was commissioned at KAPS-3 and commercially produced by ECIL.
28. Calcio-thermic reduction process (CTR) based technology for the production of Nd-Pr metal required for making NdFeB permanent magnet has been successfully developed from indigenously produced Nd-Pr oxide. A tri party memorandum of agreement (MoA) was signed to produce 3Tons/Year Nd-Pr metal in the country.

I shall now mention some of the noteworthy R&D contributions and initiatives

29. A simple, sensitive and selective method for the detection of Alkaline Phosphatase (ALP) has been developed and demonstrated successfully in human serum samples. It is an important biomarker for anaemia, chronic nephritis, hepatobiliary diseases and hypothyroidism,.
30. An Indigenously developed photo-absorption spectroscopic studies (PASS) beamline (PASS-BL07) has been commissioned at bending magnet of 450 MeV, 100 mA Indus-1 synchrotron source.

31. Around one hundred import substitute Ni/Ti multilayer based neutron supermirrors of lengths 1 meter and 0.5 meters have been fabricated for Dhruva using an in-house developed magnetron sputtering system.
32. The full scale ISMRAN (Indian Scintillator Matrix for Reactor Anti-Neutrinos) was commissioned in October 2021 and it is continuously measuring data of antineutrinos with higher statistics from the Dhruva reactor.
33. National Facility for Neutron Beam Research (NFNBR) has been used effectively and catered to 73 user experiments for users from all over India apart from about 125 in-house research experiments.
34. Based on indigenous Mass Spectrometer technology, a Helium Leak Detector has been developed. It works over a wide dynamic range and can be operated in both Vacuum and Sniffer modes. The said technology has been transferred to a private company for commercialization.

The contribution of BARC to missions of societal cause have always been one of our important mandates and I shall now like to draw your attention to achievements in this important segment of our activities and programmes.

35. In crop improvement programme, recently two rice varieties, three mustard varieties and one groundnut variety have been Gazette notified for commercial cultivation. Total of fifty-five varieties from BARC have been notified including these six varieties.
36. Joint-Agricultural Research Sub Committees (AGRESCO) approved usage of growth stimulating irradiated-chitosan technology developed by BARC in collaboration with a private institute for sugarcane crop.

37. Gamma radiation technology was used to extend shelf life of 28 tons of potatoes from typical 100 days to eight months while retaining all quality attributes. The treated potatoes were later successfully marketed.
38. Eight lots of carrier-free ^{90}Y -acetate solution were separated from $^{90}\text{Sr}(\text{NO}_3)_2$ solution and supplied to RMC, Parel for radiopharmaceutical applications.
39. A radiochemical separation process based on electro-amalgamation was successfully developed and demonstrated to obtain ^{177}Lu -Lutetium in no-carrier-added (NCA) form by using indigenously enriched ^{176}Yb -Ytterbium Oxide (Yb_2O_3) irradiated target.
40. Radiation processed shape memory polymers with excellent (>95%) shape recovery behavior was developed for various medical applications.
41. A portable and field-deployable CRISPR based method to detect SARS-CoV-2 infections, named BARC-CRISPR-CUBE, has been developed and technology has been transferred to two private entrepreneurs.
42. Three different formulations of Yttrium-90 were developed and deployed. These included Y-90 labelled glass microsphere, called Bhabhaspheres, for liver cancer treatment, Y-90 labelled hydroxyapatite particles for treating arthritis and Y-90-acetate solution for radiopharmaceutical applications.
43. Trichoderma and tamarind seed-based TrichoBARC formulation was developed and technology was transferred. The formulation was applied in seven locations across five states and resulted in 63% average yield gain over control.

Dear colleagues

The ongoing pandemic has been challenging us continuously and to meet these challenges, we have devised new ways to work. We could march successfully on our path while maintaining a safe and secure environment.

44. To minimize in-person interactions, the BARC developed video conferencing services Vmeet and DAEmeet have been augmented with call facilities and integrated with BARC and DAE single sign-on services for use across DAE.
45. eOffice system was implemented in BARC Trombay campus from 2021 onwards. Computer Division of BARC has extended the facility to outside Trombay campus using Anunet network infrastructure and therefore eOffice is now accessible at all offices of BARC.

Our Engineering Services Group ensured more than 97% overall availability of all Civil, Electrical, HVAC, Mechanical utility services & security systems and L&CM.

46. I am happy to announce that the Pilot Security Portal at TVS has been commissioned. This facility will reduce entry time of contract workers to BARC considerably.
47. The new 11kV substation at Radioactive Solid-waste Management Site (RSMS) has been commissioned. This sub-station is feeding various facilities in RSMS area such as an incinerator, solid waste processing, alpha storage, near surface disposal plant under WMD at Trombay.

Dear Colleagues, I have only presented few achievements of our Centre which were achieved only due to the sustained efforts of our scientists and technologists. On this Republic Day, I acknowledge the role played by each and every individual who have contributed to this magnificent team effort.

I would also like to take this opportunity to gratefully acknowledge all personnel providing auxiliary and support services for their contributions towards the success of our programmes. This includes the Administrative Group, Medical Group, Engineering Services Group, BARC Safety

Council, Security Section, Fire Services Section, Landscape and Cosmetic Maintenance Section, Transport Section, Catering Services and many more, who are undoubtedly one of the strengths of this organisation. Our thanks are also due to all the personnel of BARC Credit Society, State Bank of India and Indian Post who are stationed at our campus and provide services to our employees. Special thanks are also due to the unions and associations for their support and cooperation. At the end, my dear colleagues, I would like to once again extend Republic Day greetings to all of you.

Thank you, Jai Hind